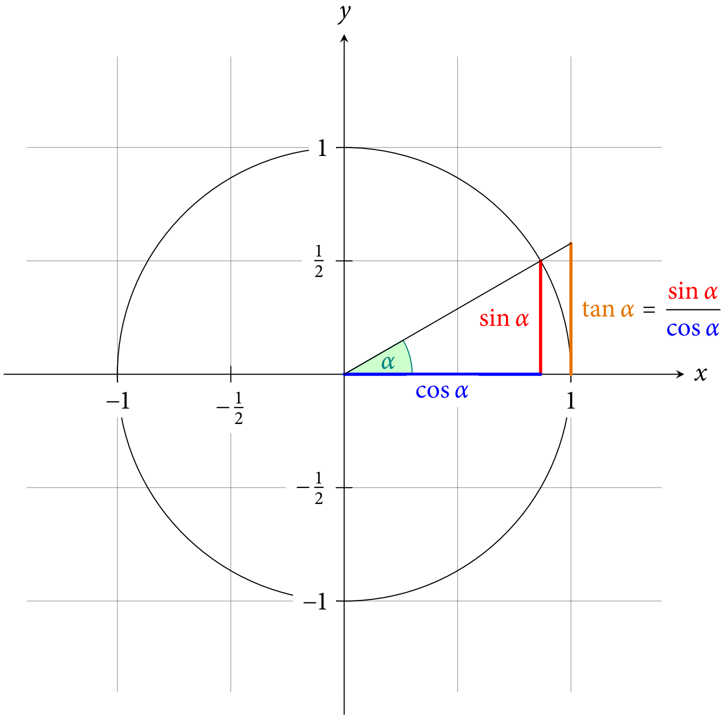
1 A TRIGONOMETRY EXAMPLE



The angle α is 30° in the example ($\pi/6$ in radians). The sine of α, which is the height of the red line, is

$$\sin\alpha = \frac{1}{2}.$$

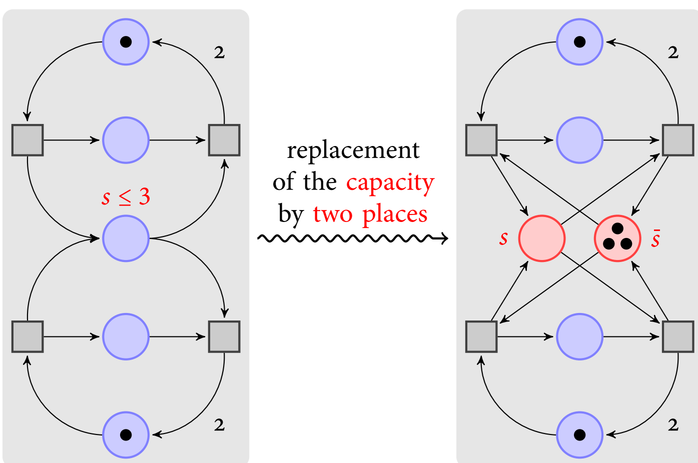
By the Theorem of Pythagoras we have $\cos^2\alpha + \sin^2\alpha = 1$. Thus the length of the blue line, which is the cosine of α, must be

$$\cos\alpha = \sqrt{1 - \frac{1}{4}} = \frac{1}{2}\sqrt{3}.$$

This shows that $\tan\alpha$, which is the height of the orange line, is

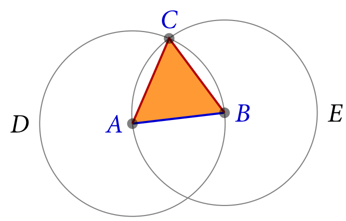
$$\tan\alpha = \frac{\sin\alpha}{\cos\alpha} = \frac{1}{\sqrt{3}}.$$

2 PETRI-NETS



3 EUCLID'S ELEMENTS

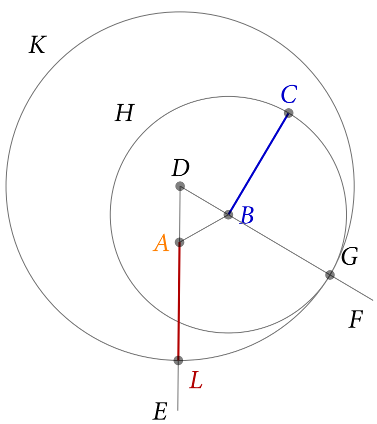
3.1 *Book I, Proposition I*



Proposition I
To construct an equilateral triangle on a given finite straigt line.

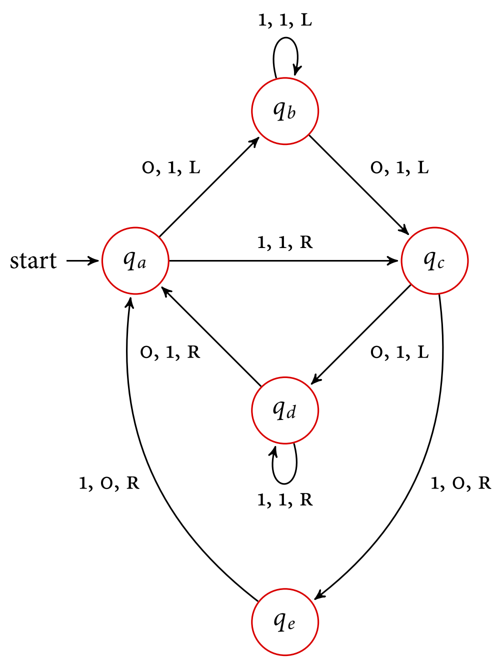
Let AB be the given finite straight line. It is required to construct an equilateral triangle on the straight line AB.
Describe the circle BCD with center A and radius AB. Again describe the circle ACE with center B and radius BA. Join the straight lines CA and CB from the point C at which the circles cut one another to the points A and B.
Now, since the point A is the center of the circle CDB, therefore ACequals AB. Again, since the point B is the center of the circle CAE, therefore BC equals BA. But AC was proced equal to AB, therefore each of the straight lines AC and BC equals AB. And things which equal the same thing equal one another, therefore AC also equals BC. Therefore the three straight lines AC, AB, and BC equal one another. Therefore the triangle ABC is equilateral, and it has been constructed on the given finite straight line AB.

3.2 *Book I, Proposition II*



Proposition II
To place a straight line equal to a given straight line with one end at a given point.

Let A be the given point, and BC the given straight line. It is required to place a straight line equal to the given straight line BC with one end at the point A.
Join the straight line AB from the point A to the point B and construct the equilateral triangle DAB on it.
Produce the straight lines AE and BFin a straight line with DA and DB. Describe the circle CGH with center B and radius BC, and again, describe the circle GKL with center D and radius DG.
Since the point B is the center of the circle CGH, therefore BC equals BG. Again, since the point D is the center of the cirlce GKL, therefore DL equals DG. And in these DA equals DB, therefore the remainder AL equals the remainder BG. But BC was also proved equal to BG, therefore each of the straight lines AL and BC equals BG. And things which equal the same thing also equal one another, therefore AL also equals BC.
Therefore the straight line AL equal to the given straight line BC has been placed with one end at the given point A.



The current candidate for the busy beaver for five states. It is presumed that this Turing machine writes a maximum number of 1's before halting among all Turing machines with five states and the tape alphabet $\{0,1\}$. Proving this conjecture is an open research problem.